Topics

- NASA Aeronautics Strategy
- FY 15 Budget Highlights
- New ARMD Structure
Why is aviation so important?

The air transportation system is critical to U.S. economic vitality.

- $1.3 TRILLION TOTAL U.S. ECONOMIC ACTIVITY (civil and general aviation, 2009)
- $47.2 BILLION POSITIVE TRADE BALANCE (civil aviation, 2011)
- 10.2 MILLION DIRECT AND INDIRECT JOBS (civil and general aviation, 2009)
- 5.2% OF TOTAL U.S. GROSS DOMESTIC PRODUCT (GDP) (civil and general aviation, 2009)
Why should I care?

Take the system view. You may not have flown today but something you needed did.

$1.6 \text{ TRILLION}

VALUE OF FREIGHT TRANSPORTED BY AIR
(exports, domestic, indirect spending, 2008)

$636.1 \text{ BILLION}

SPENT BY AIR TRAVELERS IN U.S. ECONOMY
(foreign and domestic travelers, 2008)

734 \text{ MILLION}

PASSENGERS ON U.S. CARRIERS
(domestic and international, 2012)
Aeronautics Research Supports High Quality Manufacturing Jobs

“Sales orders for all four versions of the GTF engine, which each have an estimated price of $12 million, have prompted Pratt to add nearly 500 engineers at its East Hartford, Conn., headquarters. "We haven't done this in some time," says Sue Gilbert, director of human resources…. Every business in the area, from real estate to dentists to pizzerias, could benefit.” – Time Magazine

Civil Aeronautics Manufacturing*

<table>
<thead>
<tr>
<th>Year</th>
<th>Jobs</th>
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<tbody>
<tr>
<td>2008</td>
<td>1,096,000</td>
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<tr>
<td>2009</td>
<td>1,112,000</td>
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* FAA 2011
What do emerging global trends reveal?
New realities challenge traditional approaches to strategic planning.

China and India growing economically at unprecedented rates

Asia-Pacific will have the largest middle class

The world will be predominantly urban

Revolutionary technology development and adoption are accelerating

Source: National Intelligence Council
Why are these trends important?

Challenges are multiplying and accelerating. Technology is a catalyst.

They drive global demand for air travel...

They drive expanding competition for high-tech manufacturing...

They drive “leapfrog” adoption of new technology/infrastructure...

They drive resource use, costs, constraints and impacts...
How do these trends affect aviation?

Three mega-drivers emerge.

Traditional measures of global demand for mobility – economic development, urbanization -- are growing rapidly.

Revolutions in automation, information and communication technologies enable opportunity for safety critical autonomous systems.

Severe energy and climate issues create enormous affordability and sustainability challenges.

Emissions reduction roadmap:
- "Frozen technology" emissions
- Known technology, operations and infrastructure
- Biofuels and additional technology
- Carbon neutral growth 2020
- Gross emissions trajectory
- Economic measures

Technology Convergence:
Revolution in aviation, information and communication technologies enable opportunity for safety critical autonomous systems.
How is NASA Aeronautics responding?

Research is organized into six relevant themes.

3 Mega-Drivers

6 Strategic Research & Technology Thrusts

Safe, Efficient Growth in Global Operations
• Enable full NextGen and develop technologies to substantially reduce aircraft safety risks

Innovation in Commercial Supersonic Aircraft
• Achieve a low-boom standard

Ultra-Efficient Commercial Transports
• Pioneer technologies for big leaps in efficiency and environmental performance

Transition to Low-Carbon Propulsion
• Characterize drop-in alternative fuels and pioneer low-carbon propulsion technology

Real-Time System-Wide Safety Assurance
• Develop tools for use in a prototype of an integrated safety monitoring and assurance system

Assured Autonomy for Aviation Transformation
• Develop high-impact aviation autonomy applications
What vision has NASA set for aviation?
A revolution in sustainable global air mobility.
Summary

Urgent Drivers

Innovative Solutions & High Payoff Technologies

Economic Growth
High Quality Jobs
Revolutionary Mobility
Long-Term Sustainability
Why a New Aeronautics Research Strategy?

- ARMD has solid partnerships, high relevancy and is delivering high impact results
- Now is the time to recognize the challenges and opportunities of the future and build off the solid track record that has been established
  - Rising competition in international R&D
  - Relentless challenges in mobility, energy and climate
  - Accelerating opportunities to infuse non-aerospace sector technologies to create “convergent” solutions
- Therefore, ARMD’s new strategy builds on the current leadership and focuses on enabling revolutionary advances in the 21st Century aviation

The Time Bomb of Complacency – AvWeek Editorial, September 2, 2013

“An alarm needs to be sounded. A vital and vigorous aeronautics research program is essential... NASA’s unveiling of a new strategy for aeronautics research is a bold and welcome move.”
Budget Overview

NASA has developed a compelling strategic vision for aeronautics research. This vision led to six strategic thrust areas for research to enable NASA to be responsive to a growing demand for mobility, severe challenges to sustainability of energy and the environment, and technology advances in information, communications, and automation technologies.

The strategic thrust areas are:

- Safe, efficient growth in global operations
- Innovation in commercial supersonic aircraft
- Ultra-efficient commercial vehicles
- Transition to low-carbon propulsion
- Real-time system safety assurance
- Assured autonomy for aviation transformation.

This research will continue to support economic growth and high quality jobs, and advances in mobility and long-term sustainability within the aviation industry.

NASA will continue to develop methods and technologies to support implementation of NextGen.

As NASA completes the Environmentally Responsible Aviation Project the technologies that have been developed to simultaneously reduce fuel burn, community noise and emissions will be transferred for use by the aviation industry.
## ARMD Budget Request

Outyears are Notional

<table>
<thead>
<tr>
<th>($ Millions)</th>
<th>FY 2015</th>
<th>FY 2016</th>
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ARMD Programs with Strategic Thrusts

Mission Programs

- **Airspace Operations and Safety Program**
  - Safe, Efficient Growth in Global Operations
  - Real-Time System-Wide Safety Assurance
  - Assured Autonomy for Aviation Transformation

- **Advanced Air Vehicles Program**
  - Ultra-Efficient Commercial Vehicles
  - Innovation in Commercial Supersonic Aircraft
  - Transition to Low-Carbon Propulsion
  - Assured Autonomy for Aviation Transformation

- **Integrated Aviation Systems Program**
  - Flight Research-Oriented Integrated, System-Level R&T supporting all six thrusts
  - X-Planes/Test Environment

Seedling Program

- **Transformative Aeronautics Concepts Program**
  - High-risk, leap-frog ideas supporting all six thrusts
  - Critical cross-cutting tool development